two small stations or ranches in Alaska, one in the interior, where may be secured specimens of the great moose, the great bear, and other disappearing animals of the land fauna; the other "ranch" to be on the coast for the collection of the walrus, the sea otter, the great sea lion of Steller, and other important vanishing marine species.

The animals in the National Zoological Park at the close of the fiscal year included 506 mammals, 232 birds, and 145 reptiles. The accessions of the year numbered 314. More than half of these accessions were gifts to the Government, several of the most interesting animals having been secured through the cooperation of United States consuls and other officials. A fine specimen of grizzly bear, also some antelope, deer, elk, and cinnamon bears were received from the Yellowstone National Park.

The native game, formerly everywhere plentiful, has grown so nearly inaccessible that only after years of effort have there at last been procured a single young male specimen of the great Kodiak bear and two big horn or Rocky Mountain sheep.

The Astrophysical Observatory.—The principal work of the Astrophysical Observatory during the past year has continued to be the study of the sun and its radiation. While fully acknowledging the interesting nature of astrophysical investigation of the stars and nebulæ, the study of the sun has a far superior practical importance, for were the former bodies to be wholly blotted out, they would be missed chiefly as objects of scientific interest, while with the sun would be abolished life itself. The solar researches have mainly been concerned with determining the amount and nature of the absorption of solar radiation in the earth's atmosphere and in the solar envelope. These researches are preliminary to, and form an essential part of, the measurement of the total radiation of the sun. A presumption exists, almost amounting to certainty, that the total radiation of the sun is variable in some relation to the appearance of sun-spots, but nothing is yet known to fix definitely the amount of this supposed variability or to measure its effect upon the earth, though that effect, if so fixed, cannot but be of interest to every inhabitant of the earth's surface.

The instrumental means, which thus have been the subject of incessant study and improvement here during the past ten years, for investigating such questions, are more efficient than at any previous time. The detailed report shows that automatic bolometric curves accurately representative of the amount and distribution of the solar energy at the observer's station may now be obtained in a few minutes, covering nearly the whole spectral region which reaches sea level, and where occurs much of the great and varying absorption by water vapour which influences our terrestrial temperatures so greatly.

Some twenty years ago, when Dr. Langley invented his "bolometer," the instrument was able to measure temperature to about one one-hundred-thousandth of a degree. Since then, during fifteen years of constant advance, latterly associated with a great improvement of the adjuncts, particularly of the galvanometer, at the hands of Mr. C. G. Abbot, this has been brought to measure somewhat less than one-hundred-millionth of a degree, and this almost infinitesimal amount is distinguished with readiness and precision. It is this increased precision which is associated with all the improvements in the work of the year here described.

It is the variability of the absorption of our air which now offers the greatest difficulty to the work. Dr. Langley cherishes the hope that a solar observatory will one day be established high in a clear and dry air, the chief aim of which shall be to solve the questions of the amount of radiation of the sun, the changes in this total amount, and the consequences of such changes on the earth.

The interest of this solar study is peculiar among all the subjects of astronomical research, for it is not only a scientific but a utilitarian interest of such high importance that it has among its remote possibilities the forecasting of the coming seasons and harvests, and of conditions immediately practical, from those which affect the price of the labourer's dinner up to those which, to use the weighty words of Prof. Newcomb, may bring to light not merely interesting cosmical processes, but "cosmical processes pregnant with the destiny of our race."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

Cambridge.—The General Board of Studies report that in their opinion it is expedient to reestablish the chair of surgery, which has been suspended since Sir George Humphry's death. They propose a stipend of 600*l.* a year, with freedom to undertake private practice, and the right to be *ex officio* surgeon to the hospital and to hold a college fellowship.

A special syndicate has been appointed to consider arrangements for the future conduct of the engineering department, in view of the approaching departure of Prof. Ewing. A bust of the late Dr. John Hopkinson has been presented to the Hopkinson Laboratory, and will be unveiled during the present term.

The second reading of the London Education Bill was carried in the House of Commons on April 29 by 300 votes to 163.

At a meeting of the Court of Governors of University College, Liverpool, held on May 2, the chairman alluded to the endowment of a chair of electrotechnics, for which special purpose a donation of 10,000*l.* had been made by Mr. Jardine, and stated that they hoped to receive other special donations in order to establish professorships of applied mechanics and applied mathematics. A new building for electrotechnics and biology is to be erected, which it is hoped will be one of the most perfect of the kind in the country. It was also announced that, assuming all went well, and that the charter constituting the Liverpool University College a separate university was granted in June or early in July, the necessary Act of Parliament would probably be passed during the present session.

The annual conference of the presidents, deans and executive officers of many of the institutions for the higher education of women in the United States was held this year at Smith College on April 18. The association, which numbers among its members eleven colleges for women and co-educational institutions, as well as associations and individuals, maintains a table at the Zoological Station at Naples, awarding places at it to from one to five persons each year. A place at the American Women's Table at this Station for 1903–4 was awarded to Dr. Grace Emily Cooley, associate professor of botany at Wellesley College, who will thus become scholar of the association. An additional award has, however, been made this year, that of the prize of 200*l.* offered two years ago for the best piece of scientific research work done by a woman. Twelve professors representing the biological, chemical, and physiological sciences act as board of examiners for the association. This year they considered eleven scientific investigations, and awarded the prize to Dr. Florence R. Sabin, assistant in anatomy at the Johns Hopkins University Medical School, for the results of an investigation on the origin of the lymphatic system. Honourable mention was given to the paper on the life-history of Pinus by Miss Margaret Ferguson. The prize of 200*l.* is again offered, to be awarded in 1905.

SOCIETIES AND ACADEMIES.

London.

Physical Society, April 24.—Mr. T. H. Blakesley, vice-president, in the chair.—Mr. W. B. **Croft** exhibited several novel and ingenious pieces of physical apparatus.—Dimensional analysis of physical quantities and the correlation of units, by Mr. A. F. **Ravenshear.** The object of this paper is to knit together various divergent views which are current on the subject of dimensions. It is shown that while (1) dimensional analysis and the correlation of units of different kinds can be pursued in one direction until, with completed correlation, we arrive at degrees of undifferentiated quantity, a different procedure may be followed which (2) gives rise to various systems of dimensions descriptive of the physical relationships of the quantities treated. The conditions giving rise to dimensional relations are first set out, and it is proposed to distinguish the purely quantitative reading of a dimensional formula by enclosing the sign of equality in square brackets thus :—

$$[\text{force}][=][M][L][T^{-2}]$$

and the reading of it as a physical identity or equivalence thus :—

$$[\text{force}] \equiv [M][L][T^{-2}].$$

The dimensional relation $M = L^3T^{-2}$ derived from the law of gravitation is examined at length. This relation, combined with the demand for the complete correlation of all dynamical units, is shown to require the adoption of the convention

$$[L][=][T][=][M].$$

This result is interpreted by (1) above. Systems of dimensions are next discussed, with the aid of illustrative tables, and it is shown that by employing different physical laws as bases many different systems may be constructed.—Mr. R. J. **Sowter** read a note on dimensions of physical quantities. Mr. Ravenshear has shown that any physical quantity is expressible in terms of the dynamical quantities L, M and T, in different ways, but that all the various ways are connected with one another by an index law. One interpretation of this is that the dynamical factors are complete in themselves. They express change-ratios, and have no qualitative significance. μ, k, γ, &c. do not contain dynamical factors, but carry with them the physical qualities or characteristics of the quantities associated with them. Any physical quantity, on this hypothesis, is expressible as $Q = N(D^n)q$, where N is a mere number, (D^n) is a dynamical factor indicating a quantitative measurement process, and q is a quality factor of the nature of Q.

Geological Society, April 8.—Mr. J. J. H. Teall, F.R.S., vice-president, in the chair.—On the probable source of some of the pebbles of the Triassic Pebble-Beds of South Devon and of the midland counties, by Mr. O. A. **Shrubsole.** The author describes the Budleigh-Salterton Pebble-Beds. The supposition is natural that Devonian rocks were once represented either in the Calvados district or in some region in the same drainage-area as that which has supplied the Ordovician element. The Grès de May of Normandy appears capable of furnishing abundant material, not only for the Ordovician pebbles of the Budleigh-Salterton Pebble-Bed, but also for a great deal more. A list of species common to the Grès de May, of May itself, and the Budleigh-Salterton deposit is given. The author is struck with the resemblance of the Midland Bunter to that of Devon. Strong family likenesses subsist between certain specimens in the northern and southern Bunter and some of the undisturbed rocks of Normandy. A list of fossils from the Midland Bunter contains three southern forms. Fourteen out of twenty of the Drift and Bunter fossils are found at Budleigh-Salterton and in Normandy.—Note on the occurrence of Keisley-Limestone Pebbles in the Red Sandstone-Rocks of Peel (Isle of Man), by Mr. E. L. **Gill.** Pebbles of a coarsely-crystalline, greyish-white, mottled limestone, collected by Prof. W. Boyd Dawkins from the conglomerates at Whitestrand, contain the following fossils :—*Illaenus Bowmanni*, var. *brevicapitatus*, *Primitia Maccoyi*, *Orthis calligramma*, *O. testudinaria*, *O. biforata*, *Rafinesquina deltoidea*, *Plectambonites quinquecostata*, *Atrypa expansa*, *Hyatella Portlockiana*, *Dayia pentagonalis*, *Platyceras verisimile*, *Stenopora fibrosa*, and crinoid-stems. This assemblage of fossils corresponds strikingly with that of the Keisley Limestone, and it is therefore concluded that the pebbles have been derived from that rock.

DUBLIN.

Royal Irish Academy, A ril 27.—Prof. Atkinson, president, in the chair.—Observations on the temperature of the subterranean organs of plants, by Dr. Henry H. **Dixon.** Previous experimenters on the temperatures of plants have confined their investigations to the aërial organs. Dutrochet alone experimented with subterranean organs, but only after removal from the soil. He believed that these organs are at the same temperature as their surroundings. From the experiments described in this paper we may infer that (1) subterranean organs, *e.g.* bulbs, like aërial organs, may have during active growth a higher temperature than their surroundings. The amount of this temperature-elevation may be as much as 0·06° C. (2) After the period of active growth is passed, this temperature-elevation is no longer noticeable. (3) There is no true indication of a *spontaneous* periodic diurnal rise in the temperature of subterranean organs, such as has been recorded by other writers for aërial organs. A periodic diurnal rise may occur owing to the periodicity of the temperature of the surroundings, which in its turn may cause an increase in the metabolic activity of the plant, and so give rise to a periodic elevation of temperature. (4) In the less massive subterranean organs the temperature rise is not sufficient to make itself appreciable above the fluctuations of the surroundings and the errors of experiment. The paper also contains an account of the errors affecting the thermo-electric method of determining plant temperatures, and also of some suggestions with a view to minimising them.

PARIS.

Academy of Sciences, April 27.—M. Albert Gaudry in the chair.—The president announced the death of M. de Bussy, member of the section of geography and navigation.—On the radiation of polonium and on the secondary radiation which it produces, by M. Henri **Becquerel.** The radiation of polonium differs from that of radium by the absence of rays resembling the kathode rays. The chief portion of the polonium rays possesses identical properties with the α-rays of radium and the canal rays of Goldstein. Up to the present these have been the only polonium rays known, but the author has recently recognised the existence of other rays, distinguished by their powers of penetration. These penetrating rays produce effects which are in every way comparable with the penetrating rays of radium filtered through a considerable thickness of metal. Hence it would appear that of the three distinct kinds of radiation possessed by radium, polonium possesses only two, the part missing being that of a kathodic nature.—The eclipse of the moon of April 11 at the Observatory of Marseilles, by M. **Stephan.**—Observation of the partial eclipse of the moon of April 11 at the Observatory of Bordeaux, by M. G. **Rayet.** The atmospheric conditions were extremely favourable for observations; one peculiarity noticed in the eclipse was that whereas in ordinary eclipses the entire disc of the moon can be seen during the greater part of the eclipse, in this case the eclipsed part of the moon had completely disappeared. This was noticed both in the eye observations and the photographs.—The catalytic decomposition of alcohols by finely divided metals, allyl and benzyl alcohols, secondary and tertiary alcohols, by MM. Paul **Sabatier** and J. B. **Senderens.** It has been shown in previous papers that metallic copper, prepared by the reduction at a low temperature, reacts with the primary alcohols, giving the aldehyde and free hydrogen. This reaction has now been extended to allyl, benzyl, isopropyl and other secondary alcohols. Allyl alcohol gives a 50 per cent. yield of propyl aldehyde, and benzyl alcohol gives hydrogen and the aldehyde. Secondary alcohols give hydrogen and the corresponding ketone in good yields, provided that the temperature does not rise too high. Tertiary alcohols split up into water and ethylene hydrocarbons. Reduced nickel gives rise to similar reactions, but there is a tendency to further decomposition, and the yields are not so good.—M. Noether was elected a correspondant in the section of geometry in the place of the late M. Fuchs.—On the observation of the eclipse of the Moon of April 11, by M. P. **Puiseux.** The extreme blackness of the eclipsed portion of the moon, noticed by other observers, was also in evidence at Paris.—The eclipse of the moon of April 11–12, by M. A. **Kannapell.** The results of observations made at the Observatory of the Faculty of Sciences at Paris.—On the deadening of the tremors of the ground. The application of a bath with a thick layer of mercury, by M. Maurice **Hamy.** A study of the theory of the use of mercury baths in preventing oscillations. An apparatus designed to carry out the conditions indicated by these researches was installed in the neighbourhood of a 4 h.p. gas engine with very satisfactory results.—The calculation of the time and height of high tide by means of harmonic constants, by M. Rollet **de l'Isle.**—Observations of the sun made at the Observatory of Lyons with the 16 cm. Brunner equatorial during the first quarter of 1903, by M. J. **Guillaume.** The observations are given in three tables showing the number of spots, their distribution in latitude, and the distribution of the faculæ in latitude.—On certain remarkable deformations, by M. Jules **Drach.**—On the carrying of the charge in experiments on electric convection, by M. N. **Vasilesco-Karpen.** A discussion of the question of a disc, carrying a variable electric charge, and rotating about its axis, as to how far the charge is carried round by its support? A calculation is given showing the number of turns made by the charge with respect to the disc in unit time. The slipping is proportional to the thickness of the disc and to the induced electromotive force.—On the cementation of iron, by M. Georges **Charpy.** Cementation is not limited by the solubility of carbon in iron. Under certain conditions, the iron may be completely converted into carbide of iron, or the carbon may be indefinitely converted into graphite by the action of a limited quantity of iron.—On the reduction of some compounds of the halogens with metals by hydrogen; the influence of pressure, by M. A. **Jouniaux.** The reduction of the chlorides, bromides, and iodides of silver and lead with hydrogen was studied at varying temperatures, and the experimental results compared with an expression deduced from thermodynamics.—On the electrolytic reduction of potassium chlorate, by M. D. **Tommasi.**—On a reaction giving rise to symmetrical diphenyl-pyrones, by M. R. **Fosse.** The method used consists in treating the phenol orthophosphates with potassium carbonate. Details are given for the reactions with the phosphates of phenyl, cresyl, and naphthyl.—The influence of the nature of the external medium on plant acidity, by MM. E. **Charabot** and A. **Hébert.** Those salts which favour the diminution of water in the plant are precisely those for which the ratio between the volatile acids esterified and the total volatile acidity is the highest.—The influence of the radium radiation on animals in the course of growth, by M. Georges **Bohn.**—On some proteolytic ferments associated with rennet in vegetables, by M. Maurice **Javillier.**—On the production of formic acid in alcoholic fermentation, by M. Pierre **Thomas.** Yeast cultivated in a mineral liquid containing sugar, a large surface of which is exposed to the air, may give rise to considerable quantities of formic acid if nitrogen in certain forms is present. Since ammonium salts and amides exist naturally in certain musts, it is not surprising to find formic acid in the resulting wines after fermentation.

DIARY OF SOCIETIES.

THURSDAY, May 7.

Royal Society, at 4.30.—On *Lagenostoma Lomaxi*, the Seed of Lyginodendron: Dr. F. W. Oliver and Dr. D. H. Scott, F.R.S.—On the Physiological Action of the Poison of the Hydrophidæ: Dr. L. Rogers.—Preliminary Note on the Discovery of the Pigmy Elephant in Cyprus: Miss D. M. A. Bate.

Royal Institution, at 5.—Hydrogen: Gaseous, Liquid and Solid: Prof. Dewar, F.R.S.

Röntgen Society, at 8.30.—Exhibition Evening.

Chemical Society, at 8.—(1) β-Bromonitrocamphor and β-Bromocamphoryloxime. Influence of Impurities in Conditioning Dynamic Isomerism; (2) Spontaneous Decomposition of Nitrocamphor: T. M. Lowry.—The Active Constituents of *Butea frondosa*: E. G. Hill.

Linnean Society, at 8.—The Ingolfiellidæ, fam. nov., a New Type of Amphipoda: Dr. H. J. Hansen.—The Evolution of the Marsupials of Australia: A. Bensley.—Copepoda Calanoida from the Faröe Channel, and Other Parts of the North Atlantic: Rev. Canon Norman, F.R.S.

Institution of Electrical Engineers, at 8.—Applications of Electricity in Engineering and Shipbuilding Works: A. D. Williamson.—Electric Driving in Machine Shops: A. B. Chatwood.

FRIDAY. May 8.

Royal Institution, at 9.—Rural England: H. Rider Haggard.

Royal Astronomical Society, at 5.—A Possible Cause of the Moon's Obscuration on April 11: Rev. S. J. Johnson.—*Probable papers*:—Observations of Stars Occulted by the Moon during the Eclipse of 1903 April 11: Radcliffe Observatory, Oxford.—Observations of Double Stars made with the 28-inch Refractor: Royal Observatory, Greenwich.

Malacological Society, at 8.—On the Necessity of Examining and Comparing the Animals before Determining some Species of the Genus Oliva: F. G. Bridgman.—Notes on some British Eulimidæ: E. R. Sykes.—Note on the Occurrence of *Planorbis marginatus*, Drap., and *Limnaea pereger*, Müll., in the Pleistocene of Bognor, Sussex: Alexander Reynell.

Physical Society, at 5.—A Spectroscope of Direct Vision and Minimum Deviation: T. H. Blakesley.—Mathematics of Bee's Cells: Prof. Everett.—The Coloured Map Problem: W. H. Price.—Note on the Construction and Attachment of Galvanometer Mirrors: Dr. W. Watson.

MONDAY, May 11.

Society of Arts, at 8.—Mechanical Road Carriages: W. Worby Beaumont.

Royal Geographical Society, at 8.30.—Cilicia, Tarsus, and the Great Taurus Pass: Prof. W. M. Ramsay.

TUESDAY, May 12.

Royal Institution, at 5.—The Astronomical Influence of the Tides: Prof. G. H. Darwin, F.R.S.

Zoological Society, at 8.30.—A Contribution to the Study of Double Monstrosities in Fishes: James F. Gemmill.—The Metamorphoses of *Ægeon fasciatus* and *Ægeon trispinosus*: Robert Gurney.—Descriptions of new Species of South American Coleoptera of the Family Chrysomelidæ: Martin Jacoby.

WEDNESDAY, May 13.

Society of Arts, at 8.—The Preservation of the Species of Big Game in Africa: E. North Buxton.

Geological Society, at 8.—On some Disturbances in the Chalk near Royston: Horace B. Woodward, F.R.S.—On a Section at Cowley near Cheltenham, and its Bearing on the Interpretation of the Bajocian Denudation: L. Richardson.—Description of a Species of Heterastraca from the Lower Rhætic Deposits of Gloucestershire: R. F. Tomes.

THURSDAY, May 14.

Royal Society, at 4.30.—*Probable Papers*:—The Combination of Hydrogen and Chlorine under the Influence of Light: P. V. Bevan.—On the Photo-Electric Discharge between Metallic Surfaces: Dr. W. Mansergh Varley.—The Elasmometer, a new Interferential Form of Elasticity Apparatus: A. E. Tutton, F.R.S.—On the Radiation of Helium and Mercury in a Magnetic Field: Prof. A. Gray, F.R.S., and Dr. W. Stewart; with R. A. Houston and D. B. McQuiston.—Meteorological Observations by the Use of Kites off the West Coast of Scotland, 1902: Dr. W. N. Shaw, F.R.S., and W. H. Dines.

Royal Institution, at 5.—Proteid-Digestion in Plants: Prof. Sidney H. Vines, F.R.S

Mathematical Society, at 5.30.—Generational Relations Defining an Abstract Simple Group of Order 32736: W. H. Bussey.—Points in the Theory of Continuous Groups: Dr. H. F. Baker.

Society of Arts, at 4.30.—The Province of Assam: Sir James Charles Lyall, K.C.S.I.

Institution of Electrical Engineers, at 8.—Applications of Electricity in Engineering and Shipbuilding Works: A. D. Williamson.—Electric Driving in Machine Shops: A. B. Chatwood.

FRIDAY, May 15

Royal Institution, at 9.—The Origin of Seed-Bearing Plants: D. H Scott, F.R.S.

Epidemiological Society, at 8.30.—The Etiology of Leprosy: Jonathan Hutchinson, F.R.S.

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